what is known of the anatomy and embryology of the various forms.

In the first place the diagram given on page 123 shows the lines of development of certain groups passing through other existing groups, an arrangement which should be avoided in phylogenetic tables. It always suggests that the groups passed through are the direct ancestors of the group at the free end of the line, and it is highly improbable that any existing forms are precisely the same as the ancestors from which a group was derived. To take an example, Uljanin represents the line of evolution of *Doliolum denticulatum* passing through first *Anchinia rubra*, and then *D. mülleri*, thus suggesting, I hold, that the two last-named species are extinct forms which were direct ancestors of *D. denticulatum*. Now of course *A. rubra* and *D. mülleri* are not extinct, and although they are undoubtedly closely related to ancestral forms on the line of development terminating in *D. denticulatum*, still it is very unlikely that they are in all respects identical with these ancestral forms. The best way to represent such a case diagrammatically would be to place *A. rubra* and *D. mülleri* on the ends of short side branches springing from the main stem at the points which the ancestral forms they seem to resemble probably occupied. In that way the line of evolution of *D. denticulatum* would be shown as passing not *through*, but *close to*, *A. rubra* and *D. mülleri*.

Uljanin represents the Appendiculariidæ giving rise to the Ascidiæ Simplices, from which three lines then diverge, one leading to *Salpa*, the second to the Doliolidæ through *Anchinia*, and the third to the Ascidiæ Compositæ. From this last group (presumably only the typical Compound Ascidians) three lines start upwards, leading,—the first to *Pyrosoma* through *Distaplia* (?), the second to *Botryllus*, and the third to the "Social" Ascidians through *Pseudodidemnum* and *Tridideninum*.

The starting-point in this scheme of evolution is undoubtedly correct. The various existing groups of Tunicata are all descended from common ancestral forms closely resembling the Appendiculariidæ. But the origin of the Salpidæ and the Doliolidæ from groups of the Simple Ascidians is very questionable. The passage from *Appendicularia mossi*[1] through *Anchinia rubra* to *Doliolum*, and through the ancestral Doliolidæ to *Salpa*, seems so simple and natural that it makes it very unlikely that the Thaliacea were ever fixed Simple Ascidians which have undergone great modification and have become free-swimming pelagic organisms again. The argument made use of by Uljanin that the Thaliacea, &c., have not such a typical method of development as the Simple Ascidians, and are therefore a younger group, is not necessarily of great value, since the process of development may have undergone modification.

Then, again, it seems more probable that the Simple and the Compound Ascidians were derived from a common ancestor resembling the simpler forms of the two groups (*e.g. Ciona* and *Diazona*) than that the Compound were derived from the Simple. Many of the Simple Ascidians show far more differentiation and far more specialisation of certain important organs (*e.g.* the branchial sac in the Molgulidæ) than is found in any of the Compound Ascidians.

I must protest against Uljanin's statement that the "Social" Ascidians are a group derived from the Compound forms and having no close connection with the Simple Ascidians. This view is opposed to all we know as to the very close relationship[2] between the Clavelinidæ and the Ascidiidæ. There can, I think, be no doubt, after the examination of such a series of forms as *Diazona*, *Clavelina*, *Ecteinascidia*, and *Ciona*, that the "Social" Ascidians (Clavelinidæ) are intermediate between the least modified forms of the Simple Ascidians (*e.g. Ciona*) and the least modified forms of the Compound Ascidians (*e.g. Diazona*), and ought therefore to be regarded as being closely allied to the ancestral forms from which both Simple and Compound Ascidians were derived.

I agree with Dr. Uljanin in considering *Pyrosoma* a modified Compound Ascidian, but I differ from him inasmuch as I regard it as being derived from the family Didemnidæ, and not from *Distaplia*. The remarkable new genus *Cœlocormus*, found during the *Challenger* Expedition,[3] is a valuable connecting-link between *Pyrosoma* and the primitive Didemnidæ, which in their turn were derived from the primitive Distomidæ, thus carrying the origin of *Pyrosoma* back to the typical Compound Ascidians.

Distaplia, which figures in Uljanin's scheme as the stepping-stone to *Pyrosoma*, is not really such an extraordinary form as has been supposed. It is an ordinary Compound Ascidian belonging to the family Distomidæ. The Didemnidæ (*e.g. Tridideminum*) and the Diplosomidæ (*e.g. Pseudodidemnum*) are not at all closely related to the "Social" Ascidians. They are highly modified and in some respects degenerate Compound Ascidians which have probably originated from the primitive Distomidæ.

Dr. Uljanin is, I think, right in regarding the Botryllidæ as an abnormal group of Compound Ascidians worthy of being placed in a branch by themselves. They show certain resemblances to some of the Simple Ascidians, and it is just a question whether they should not be regarded as a remarkably modified offshoot from the primitive Cynthiidæ quite distinct from the other Compound Ascidians. I am inclined to regard the Compound Ascidians as polyphyletic. There is some evidence in favour of their having arisen as three distinct groups from the ancestral Social and Simple Ascidians, and in that case one of these groups would be the Botryllidæ. This question will be discussed more in detail in a paper I am now preparing on the Phylogeny of the Tunicata.

On some points, then, I am quite in accord with Dr. Uljanin, while we differ on others. With the modifications suggested above I would accept his views. Probably the most valuable part of his scheme is that dealing with the evolution of the Doliolidæ, and the relations between the different forms of *Doliolum* and *Anchinia*. W. A. HERDMAN

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[1] I have ventured to call by this name a species described as new, but not named, by Dr. Moss (*Trans. Linn. Soc. Lond.*, vol. xxvii. p. 229, 1871).

[2] See Herdman, "Report upon *Challenger* Tunicata," part i., and Sluiter, "Ueber einige einfachen Ascidien," &c., *Natuurkundig Tijdschrift v. Nederlandsch-Indie*, Band xlv. p. 160, 1885.

[3] See "Report upon *Challenger* Tunicata," part ii.

SCIENTIFIC SERIALS

The Quarterly Journal of Microscopical Science for February 1886 contains:—On the development of the mole (*Talpa europæa*); the ovarian ovum and segmentation of the ovum, by Walter Heape, M.A. (plate 11). Of the two membranes the outer (zona radiata) was thick, the inner (vitelline) thin; between them there was a space; radial canals exist in the outer membrane; no micropyle was observed. Two kinds of yolk are noticed—homogeneous vesicular and minute highly refractive bodies. During maturation the vitellus divided into a medullary and cortical portion, and withdrew from the vitelline membrane, excepting where connected by pseudopodia-like processes, and at the spot where the polar bodies are formed. A single spermatozoon appears to effect impregnation. Segmentation occurs while the ovum traverses the Fallopian tube.—On the development of the Cape species of Peripatus, by Adam Sedgwick, M.A., part 2 (plates 12-14). This part is chiefly devoted to a consideration of the segmentation of the ovum and the formation of the layers. The important and in several cases novel facts brought to notice do not readily admit of being abstracted. The embryo at the gastrula stage and in all the earlier stages of development is a syncytium: no part of the nucleus or centre of force of the unsegmented ovum enters the clear endoderm masses. The gastrula gut arises from an enlargement and confluence of the vacuoles in the centre of the mass.—Studies on earthworms, by W. B. Benham, B.Sc. (plates 15, 16, 16 *bis*). In this series of papers the authors describe a number of earthworms from various parts of the world, placed at his disposal by Prof. Lankester; these include new genera and species. In this paper, after an historical *résumé*, a notice of the hitherto known genera and species is given, and *Microchæta rappi*, Bedd., is described and figured.—The official refutation of Dr. Robert Koch's theory of cholera and commas.

The Journal of the Royal Microscopical Society for February 1886 contains:—Fresh-water algæ (including chlorophyllaceous Protophyta) of the English Lake District, with descriptions of twelve new species, by A. W. Bennett, F.L.S. (plates 1 and 2). A record of a six weeks' collecting in the district between Windermere and Langdale, and no doubt only an indication of what a more protracted study would do for the Lake flora.—Explanatory notes on a series of slides presented to the Society, illustrating the action of a diamond in ruling lines upon glass, by Prof. W. A. Rogers.—On the preparation of sections of pumice-stone and other vesicular rocks, by Dr. H. J. Johnston-Lavis.—On the cultivation of Bacteria, by Dr. E. M. Crookshank (plates 3-5).—On the appearance which some micro-organisms present under different conditions—as exemplified in the microbe of chicken-cholera, by G. F. Dowdeswell, M.A.

(plate 6).—On "central" light in resolution, by J. W. Stephenson, F.L.S.—With the usual summary of current researches and the proceedings of the Society.

The Journal of Physiology, vol. vii., No. 1, January 1886, contains but one memoir, but that an important one by Dr. W. H. Gaskell, on the structure, distribution, and function of the nerves which innervate the visceral and vascular systems (plates 1-4). If the various nerves of different function which are described as innervating the viscera have a real and separate existence, then, as in the case of the motor nerves of ordinary skeletal muscles, a similar correlation must exist between their function and their morphological arrangement. In a series of papers the author proposes to deal with this question for all the different groups of nerves, classifying them according to function, and including afferent as well as efferent nerves. In the present memoir he confines himself to the efferent nerves of the vascular and visceral muscles, treating of the structure and distribution of these nerves; of the nature of the action of the motor and inhibitory nerves of the same, and he further treats of the morphology of the superior cervical ganglion; on the central origin of the ramus visceralis; on the relation of the posterior root ganglia to the visceral nerves; and on the roots of the cranial nerves.

The American Journal of Science, February.—The story of Biela's comet, a lecture delivered at the Sheffield Scientific School of Yale College on March 9, 1874, by A. Newton. This paper is here reproduced in consequence of the renewed interest created in Biela's comet by the meteoric display of November 27, 1885.—Relation between direct and counter-electromotive forces represented by an hyperbola, by H. S. Carhart. In discussing the relations between the electromotive force (E.M.F.) of the generator, the counter E.M.F. resulting from the electromagnetic reactions taking place in the motor, and the rate at which energy is absorbed by the latter in the electrical transmission of power, it is implicitly assumed that E is constant. Here it is shown that, with an assumed amount of work spent upon the motor per second and a given resistance R, E has a minimum value equal to twice E ; this corresponds with Jacobi's law of maximum rate of working or greatest electrical activity and constant E.M.F.—Tendril movements in *Cucurbita maxima* and *C. Pepo* (continued), by D. P. Penhallow. From 436 distinct observations upon the motion of the tendrils and terminal bud under all conditions of temperature, sun and humidity, a normal rate of movement under all conditions to which the plant is ordinarily subjected, has been determined at 0·351 m. per minute. In the terminal bud the greatest movement occurred about noon under conditions of great humidity, the least at night, also during great humidity. In all the results so far obtained we have still further proof of the influence of meteorological conditions on the growth of the plant.—A theorem of maximum dissipativity, by George F. Becker. The proposition here demonstrated is that in all moving systems there is a constant tendency to motions of shorter period, and that, if there is a sufficient difference between the periods compared, this tendency is always a maximum. Hence all natural phenomena occur in such a way as to convert the greatest possible quantity of the energy of sensible motion into heat, or the greatest possible quantity of heat into light, &c., in a given time, provided that the interval of time considered exceeds a certain fraction of the period of the most rapidly moving particles of the system.—A new law of thermo-chemistry, by George F. Becker. Considering chemical energy as a form of motion, and accepting Berthelot's thermo-chemical law of maximum expenditure, the author seeks to ascertain whether any definite results may be reached as to the rate of evolution of heat. The principle arrived at is set forth in the previous paper, the chemical interpretation of which is thus summed up: the sum of the chemical and physical transformations in any chemically active system will be such as to convert higher forms of energy into heat, light, &c., at the greatest possible rate, provided that the interval of time for which the comparison is made is a multiple of a certain fraction of the period of the most rapidly moving particles of the system. This is practically equivalent to the statement that the transformation will be such as to evolve heat, light, &c., at the highest possible rate.—Recent explorations in the Wappinger Valley limestone of Dutchess County, New York, by William B. Dwight. This paper, the fifth contribution on the subject, deals with the discovery of fossiliferous Potsdam strata in the Poughkeepsie district, New York.—Wind-action in Maine, by George H. Stone. Drifting sands, partly of marine, partly of fresh-water deposition, are common in Maine. But here two less common phases of wind-action are considered,—till-burrowing, such as is frequently observed in Colorado, and sand-carving, as seen in the grooves, scratches, and striated polished surfaces of the boulders scattered over several square miles, and already described in Hitchcock's Report on the Geology of Maine (1861).—The westward extension of rocks of Lower Helderberg age in New York, by S. G. Williams. It is shown that the Lower Helderberg period, including all above the Water-lime group, is represented at least as far west as Cayuga Lake by limestones not less than 65 feet thick, containing an unmistakable Lower Helderberg fauna.—Meteoric iron from Jenny's Creek, Wayne County, West Virginia, by George F. Kunz. This specimen, picked up in 1883, is octahedral, belonging to the "grobe Lamellen" of Brezina's new classification, and yielding on analysis: iron, 91·56; phosphorus, 0·13; nickel and cobalt, 8·31;—specific gravity, 7·344.

The American Naturalist for February 1886 contains:—On the post-mortem imbibition of poisons, by Dr. George B. Miller. Treats of a subject of a highly interesting character from its medico-legal aspect.—Notes of an ascent of the volcano of Popocatapetl, by A. S. Packard (woodcuts). The ascent was made from Amecameca (a town forty miles by rail from Mexico, and 8223 feet above the sea) at 1 p.m.; a rancho where the party stopped for the night was reached at 5.40, twelve hours after the ascent proper began; it was for two hours on horseback, and then on foot for three hours and a half. While it was hard work, there were no dangers or difficulties. No notes of the vegetation are given.—Notes on the Œcodomas or leaf-cutting ants of Trinidad, by C. Brest (woodcuts).—The Flood-Rock explosion, by W. H. Ballou.

March 1886:—On the migrations of Siouan tribes, by Rev. J. Owen Dorsey.—The torture of the fish-hawk, by J. Lancaster.—A study of garden lettuce, by Dr. E. L. Sturtevant.—Aquatic respiration in soft-shelled turtles, by Simon H. and Susanne Phelps Gage.—This is a very valuable contribution to the physiology of respiration in vertebrates. By comparing the free gases found in water with those in the same water after a turtle had been immersed in it without access to air, it was found that a turtle, weighing two pounds, in ten hours removed from the water 71 milligrammes of free oxygen and added to it 318 milligrammes of carbon dioxide.—On a new sub-species of the common Eastern Chipmunk (*Sciurus striatus*), by Dr. C. H. Munair.—Fish remains and tracks in the Triassic rocks at Weehawken, N.J., by O. T. Mason.

Journal of the Russian Chemical and Physical Society, vol. xviii. fasc. i.—On the influence of contact on the course of chemical transformations, by Prof. D. G. Mendeléeff.—On the specific gravity of aqueous and alcoholic solutions of mercuric chloride, by J. Schreder.—Thermic data for the group of aromatic compounds, by Werner. The thermic effects accompanying the neutralisation and dissolution of di- and tri-oxybenzoic acids and di- and tri-phenols are determined and verified.—On the action of the tri-carbonate of potassium on salts of nickel and cobalt, by F. P. Rosenblatt. This reaction is proposed as a new method of separation of the above metals and of their qualitative determination also.—On the action of sulphuric acid on oleic acid, by M. Sabaneyeff. Important for dyeing industry; the literature on the subject is given.—On azocumol, by Pospekoff; and on one of the xylidines, by E. Wroblewski.—On the heating of the glass of condensators in consequence of the alternative electrisation, by M. J. Borhman. The author comes to the conclusion that the heating of the glass in consequence of the rapid successive charges and discharges is very nearly proportional to the square of difference of potentials of the charges.—On the demonstration of the second Kirchhoff's theorem concerning the ramification of electric currents, by J. Borhman.—On the geometrical demonstration of the conditions of minimum declination of a ray in the prism, by V. Lermontoff.

Bulletins de la Société d'Anthropologie de Paris, tome viii., fasc. 3.—Sequel to M. Verrier's paper on the various modes of delivery practised among the women of civilised and savage nations.—Report of M. Hovelacque's address at the third meeting of the Transformist Conference, on the evolution of language. This treatise cannot be commended on the score of originality or profoundness of knowledge, or even as contributing in any way to the advance of philology.—Hypothetical suggestions as to the origin of right-handedness or left-handedness, by M. Dareste. The author believes that we must seek in embryonic relations for the preponderance of the right hand over the left, in which he sees a possible result of the position generally maintained by the fœtus in regard to the vitellus, in which one side of the body enjoys greater freedom for development than the opposite one. Dr. Dareste wishes to verify, by the observation of others, his hypothesis that left-handedness is present in those who suffer from inversion of the viscera (heterotaxy), which would seem to be unquestionably due to malposition in the fœtal state.—M. Sebillot has presented to the Society a comprehensive formula of questions relating to the appearance, character, and various other phenomena of the sea, together with the popular legends and superstitions connected with it by different races. These he wishes to see incorporated with the Society's authorised directions for travellers.—Note on May celebrations in the Gironde, by M. Daleau.—Discussion on the assumed Quaternary jaw found at Châlons-sur-Marne, and forming part of M. Nicaise's collection. M. Topinard, who gave the result of his own measurements, considers that the differences between this jaw and the one found at Naulette prove the co-existence, in primæval ages, of different human types. The Naulette jaw he regards as unique of its kind, differing as it does from the thousand and upwards of inferior maxillæ which he had examined with special reference to this question. — On the difficulties of distinguishing between genuine prehistoric trepanning and recently effected injuries of the crania, either through accident in the process of exhumation, or for purposes of deception, by M. Manouvrier.—On the best means of measuring the cranial capacity, by M. de Jouvenrel.—On Broca's method of determining cranial cubage, as exemplified by means of a bronze test-cranium, by M. Topinard.—On an archæological exploration on the Island of Téviec, near Quiberon, by M. Gaillard. The similarity of the dolmens, shells, and bones with those on the neighbouring mainland, and the numbers and character of the silex and bone fragments found on the island, lead the writer to believe that a separation from the continent has been effected since prehistoric ages.—On the Dutch dwarf known as Princess Pauline, by M. Mortillet.—On curious methods of conducting barter in parts of Asia and Africa, by M. Hovelacque. In tracing the history of the development of the process of bartering silently and from a distance, which still prevails between tribes or castes who refuse to meet or be seen by each other, the author draws attention to notices by Herodotus which prove the existence of the same customs among the people of Libya.—On the existence of wars in primæval times, by Dr. Hoffman, of Washington.—On the finds of a cave near Ojcow, by M. Zaborowski. Numerous fragments of the bones of the mammoth, rhinoceros, hyæna, and cave-bear were found intermixed with those of the ox, horse, hare, &c., together with flint knives, bone implements, &c.—On the brain of an insane woman, by M. Rey.—On a case of microcephalism, by M. Letourneau.—On a gibbon-fœtus and its placenta, by M. Deniker.—On ideas and memory, by M. Fauville. In this elaborate treatise the author considers memory as the result of special manifestations of the impressionability of the sensient cellules of the brain, while ideas are defined as the consequences of sensations.—On the common origin of Malays and Dravidians, by M. O. Beauregard. In this sequel to his former paper on the subject of the Malayan races the author begins with their language, which may be traced from the Moluccas as far west as Easter Island, many words in use among the inhabitants of the various island-groups that lie between these remote limits being absolutely the same. This paper is an exhaustive compendium of what has been written by other authors, chiefly Englishmen, on the language and legendary literature, the political and social constitution, and the religion and laws of the Malayan and Dravidian races, with special reference to those settled in Ceylon.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 11.—"The Electrical Phenomena accompanying the Process of Secretion in the Salivary Glands of the Dog and Cat." By W. Maddock Bayliss, B.Sc., and J. Rose Bradford, B.Sc., Senior Demonstrator of Anatomy in University College, London (from the Physiological Laboratory of University College). Communicated by E. A. Schäfer, F.R.S.

March 11.—"The Influence of Stress and Strain on the Physical Properties of Matter. Part I. Elasticity (continued). The Internal Friction of Metals." By Herbert Tomlinson, B.A. Communicated by Prof. W. Grylls Adams, M.A., F.R.S.

An abstract of a paper on this subject has been already published (*Proc. Roy. Soc.*, vol. xxxviii. p. 42), but the paper itself was withdrawn for the purpose of revision. The fresh experiments which have been for this purpose instituted during the last year, besides confirming the results of the older ones, as far as the latter have been published, have furnished, more or less in addition, the following facts relating to the internal molecular friction of metals:—

The proportionate diminution of amplitude is independent of the amplitude, provided the deformations produced do not exceed a certain limit. This limit varies with the nature of the metal, and is for nickel very low.

The logarithmic decrement of amplitude increases with the length of the vibration-period, but in a less proportion than the latter, and in a diminishing ratio. The amount of increase of the logarithmic decrement, attending on a given increase through a given range of the vibration-period, varies with the nature of the metal, and with those metals which possess comparatively small internal friction becomes almost insensible. It follows as a consequence that the internal friction of metals differs from the viscosity of fluids, for in cases of damping by the latter the logarithmic decrement is *inversely* as the length of the vibration-period.

Permanent molecular strain resulting from loading not carried to a sufficient extent to produce sensible permanent extension, diminishes the internal friction, and increases the torsional elasticity.

Considerable permanent longitudinal extension and permanent torsion produce increase of internal friction and diminution of torsional elasticity. The effect of torsion is much greater than that of extension, and the increase of internal friction is much greater than the decrease of torsional elasticity. As a consequence, wire-drawing, where we have permanent extension and torsion combined, sometimes increases enormously the internal friction; in fact, in the case of six different metals it was found that, by careful annealing, the internal friction was decreased from *one-half to one-thirtieth* of the original amount of friction of the metals in the hard-drawn condition.

The internal friction of a metal wire, whether in the hard-drawn or annealed condition, is temporarily decreased, and the torsional elasticity is temporarily increased by loading not carried beyond a certain limit; beyond this limit both the friction and the elasticity become independent of the load.

The "fatigue of elasticity," discovered by Sir William Thomson in metal wires when vibrating torsionally, is not felt, provided the deformations produced do not exceed a certain limit, depending upon the nature of the metal. The above-mentioned limit is extraordinarily low for nickel, so low, indeed, that it is difficult to avoid "elastic fatigue" with this metal. This last consideration, and others founded on the results of experiments on the effects of stress on the physical properties of nickel, tend to show that the molecules of this metal are comparatively easily rotated about their axes.

The author agrees with Prof. G. Wiedemann, that the loss of energy due to internal friction in a torsionally vibrating wire is mainly due to the to-and-fro rotation of the molecules about their axes; any cause, therefore, which increases the molecular rotatory elasticity diminishes the internal friction, and conversely.

The molecules of a metal tend to creep into such positions as will ensure a maximum molecular rotatory elasticity, and they can be assisted in doing so by agitations effected either by thermal or mechanical agency; hence—

Rest after suspension, aided by oscillations at intervals, diminishes the internal friction of a wire which has been recently suspended, or which after a long suspension has been subjected to considerable molecular agitation by either mechanical or thermal agency.

On the contrary, when a maximum molecular rotatory elasticity has been reached, molecular agitation, if carried beyond a certain limit, diminishes the elasticity; hence the results of "fatigue of elasticity;" and hence—

Mechanical shocks and rapid fluctuations of temperature beyond certain limits may considerably increase the internal friction, and, though to a much less extent, diminish the torsional elasticity.